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# Outbreak Management and COVID-19 Pandemic

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## Abstract

Humanity has battled with various epidemics, pandemics and natural disasters throughout history since it began to live in communities, still continuing to do so. In the past, it was very difficult to overcome many of these phenomena both at global and regional level, and even many people were killed. However, during the plagues, countries attempted to develop a number of strategies, tactics and methods within the scope of combating the epidemic. At this point, these struggles, measures and actions have facilitated prevention and spread of outbreaks, and sometimes they have not been sufficiently efficacious. On the other hand, struggles with epidemics, pandemics and natural disasters, which deeply affect all segments of the society in terms of social, cultural and economic aspects as well as mental and physical health, have been inherited to the present day, becoming a vast accumulation of practices to be re-applied in possible disasters humanity will face. The main point lies in the fact that here is that the struggles fought in traditional societies and modern societies have different characteristics. Especially in those traditional societies where medicine and technology are underdeveloped, the struggles carried out within uncertain constraints have caused pandemics and epidemics to last longer. The modern society we live in today, on the other hand, is on the verge of several risks and threats unlike traditional societies. When we consider the modern society within the risk society approaches, the present risks should also be thoroughly discussed. In this context, epidemics, which are a type of natural disaster, and the methods of combating them should be investigated within the framework of risk and crisis management due to the risks in modern society.

**Keywords:** outbreak management, risk management process, outbreak

## 1. Introduction

Considering the history of outbreaks as a biological phenomenon, it is obvious that they are as old as human history. The most fundamental aspect of this interpretation lies in the acceptance that microorganisms that cause diseases are also much older than human history. The microorganisms, which are the main source of outbreaks that cause the mass casualties, have not been recognized for a long time because they are too small to be discovered. However, it is possible to evaluate the lifestyles in traditional societies as one of the involving factors in the lack of knowledge about the diseases [1]. Since the risk of contracting any epidemic disease was low in traditional society periods when there was no sedentary life and people relied their lives on hunting and gathering, it was nearly impossible to know about these diseases. On the other hand, it was not possible for the outbreak to be lasting for a

long time because the persistence of the disease among people required the need for a large human population. However, with the subsequent transition to sedentary life, many contributing factors have also emerged, causing the diseases to spread easily. Consequently, awareness about outbreaks has increased and the names and systematic of outbreaks in history have started to be discussed [2].

The outbreaks are classified and termed according to their scientific structure and characteristics, spreading areas and the size of population they affect. At this point, an outbreak is divided into three categories as endemic, epidemic and pandemic. In ancient Greek, the word “en” means inside and the word “demos” means people. Derived from the combination of these two words, “endemics” is the term used to describe a disease that has always existed in a given population and can survive in a given population without external influence. The word “epidemic” is derived from the combination of the ancient Greek words “epi” meaning on or over and “demos” meaning people. In order for a disease to be defined as an epidemics, it must be prevalent in a certain human population within a certain period of time and have a pervasive effect more than expected compared to previous experiences. Finally, the term pandemic is derived from the ancient Greek word “pan” meaning all and “demos” meaning people. Unlike endemics and epidemics, pandemics refers to the type of disease that spreads over a continent or even the entire world [3].

The typical course of the disease in a pandemic with a global impact is explained as follows: The infection spreads to healthy people in a short time. It is acute and severe in its course. Those who contract the infection either die or recover completely in a short time. Finally, the survivors can develop long-term or lifelong immunity to the infection. Indicating a typical cycle of an infectious outbreak, the above steps have caused numerous casualties throughout history and left indelible marks in the areas they affected. These infections emerged as epidemics, some of which lasted for a short time or a long time, but each time caused many deaths, and humanity tried to take measures against and overcome them. On the other hand, the outbreaks have led to momentous economic, administrative, social and political changes in societies other than casualties [4]. Given the effects of past and recent epidemics on individuals and society, it is seen that epidemics are not only biological phenomena that threaten the public health but also diseases that trigger changes and transformations in all areas of life [5].

The outbreaks whose prevalence and recognition increased as humanity started to live in large settlements with crowded groups caused millions of people to suffer and lose their lives throughout history. Regarding epidemics, Diamond stated that the disease has an exclusive cycle in itself [6]. According to Diamond, epidemics are defined as the type of disease during which the sick people infect the people around them rather than individual chronic cases and the majority of the population contracts the disease in a very short time. In addition, another major characteristics of epidemics is that they progress acutely and ultimately result in death or recovery in a short time [6]. Due to their inherent characteristics, epidemics have culminated in great political, social, economic, cultural and psychological devastation in the societies where they emerged. The literature review shows that approximately three major plagues, seven cholera outbreaks and more than 10 influenza pandemics have occurred since ancient times, affecting the entire social order. Epidemic outbreaks of smallpox, yellow fever and malaria have had almost as devastating effects as the pandemics aforementioned [7].

When the diseases that broke out in the past are examined, as stated above, people and their established systems were affected in terms of politics, socio-economic life, and mental health. The epidemics have exerted great impacts that even changed the course of battles and led to changes in power and order. When the battles in history are examined, it is seen that the epidemics changed the outcome

of many wars, caused the collapse of empires, and even states used these epidemics as a martial strategy [6]. As a matter of fact, the Peloponnesian wars are one of the most popular examples showing that epidemic diseases affect the results of wars [8]. Thucydides [9] explained the severity of the disease that plagued the Peloponnesian Wars and changed the course of the war in favor of the Athenians with the following words: “The disease was so severe that no one knew what would happen, and respect for everything divine and venerable was lost.” As a matter of fact, even Pericles, the honourable statesman of the Athenians, died during the war due to the epidemic. Besides affecting the results of the wars, epidemics also affected the military organization and the urban planning and castle architecture [10]. In the Roman Empire, for example, the duty of the military medical troop is commissioned not only to treat the soldiers wounded in wars, but also prevent the spread of epidemics. However, it is estimated that epidemics caused significant problems in economic and commercial life, increased the cost of goods and services, social confusion and chaos caused by mass migration. In addition, the death rates caused by the epidemics experienced in the past were quite high compared to those by others. The major reasons for can be listed as inability to make an early diagnosis of the disease and determine the source as well as lack of means to prevent the transmission routes, and lastly primitivity of technology [5].

When the epidemics in history are examined, one of the epidemics that claims mass deaths other than the bubonic plague and cholera and continues to do so even today is the influenza epidemic. It is the most common acute and febrile respiratory disease in its broadest meaning [1]. The disease, also called as influenza in medicine, is caused by A, B and C type viruses. Its course can be mild and uncertain, and in some cases, complications that cause death may occur. The worst complication is pneumonia caused by the infection affecting the lungs. It is known that the influenza is an infectious disease which have caused more than 10 pandemics most of which originated from China since ancient times. Unlike diseases such as plague, cholera, smallpox, measles or malaria, the influenza is not a viral disease that causes death or deformities in the human body in a short time. The most prominent characteristics of influenza is that the virus causing the infection can be mutated continuously and the treatment of the disease can vary in parallel with its changed state. Therefore, it may take long time to provide treatment against the influenza caused by viruses not recognized by the body [1].

The first known influenza epidemic in history struck Italy and France in 1173. The epidemic in 1580 can be considered as the first one in history. It occurred in Asia and spread to Africa, Europe and the U.S. Later, another epidemic that started in Russia between 1729–1733 pervaded the whole Europe. Then, in 1781, another influenza pandemic, started in China and spread throughout Europe and the U.S. Moreover, with the development of transportation and communication networks, influenza epidemics have become more and more prevalent. As a matter of fact, three more pandemics occurred between 1830–1831, in 1883 and 1889–1890. The most remarkable of these pandemics broke out in Russia between 1889–1890, then spread to Europe and was called as the Russian Flu [11]. By 1918, another epidemic called Swine Flu occurred in three waves, again causing the deaths of millions of people. During the epidemic encountered in this period, it was found that more than four million people died in the U.S. alone [1]. In the subsequent periods, three more influenza pandemics originated from China and spread to different continents. During the Asian Flu in 1957 and the Hong Kong Flu pandemics in 1968–1970, more than one million people died worldwide. These pandemics were followed by SARS (Severe Acute Respiratory Syndrome) in 2003, Swine Flu in 2009–2010, MERS (Middle East Respiratory Syndrome) in 2015 and lastly 2020 COVID-19 Pandemic caused by Coronavirus. When the vast epidemics and



pandemics in the history are examined, it is obvious that the plague, cholera and influenza outbreaks generally emerge as pandemics. On the other hand, those epidemics and endemics that were effective in the region where they originated have reached dimensions that could threaten human health and have caused mass deaths. The most common of these diseases include smallpox, measles, mumps, typhoid, typhus, HIV/AIDS, malaria, fever and EBOLA [5].

By definition, the concept of risk management does not necessarily mean preventing the risk completely, but rather refers to approaching the problems systematically and carefully as well as preventing unnecessary losses through careful management of the risks that are decided to take [12].

The important points in risk management involve recognizing the risk clearly enough, diagnosing it correctly, seeking ways to eliminate the risk, and transferring the risk by minimizing it. In this context, in order to overcome the Covid-19 pandemic process with the least damage, the precautions must be absolutely examined in view of risk management. In addition, crisis management, which will maximize the success of risk management, should not be undermined. Therefore, the definition of crisis refers to a difficult moment or a certain period of depression in the life of a person, an organization or a society. In this respect, when the crisis is evaluated, its uncertainty includes the possibility of harm and risk within itself [13]. Hence, considering the relationship between risk management and crisis management, it is necessary to state that the risk precedes the crisis and so does the risk management. However, it is also apparent that there is a relational cycle between risk management and crisis management processes in terms of epidemic management. If more risk factors identified in the epidemic management process are reduced and the probabilities are predicted better, then they can be used more often in determining future projections along with more precautions taken to reduce risks and develop appropriate policies, which ultimately contributes to more effective crisis management from the moment the crises occur [4].

In this context, successful implementation of the activities conducted to battle against the epidemic around the world and in Turkey, it is imperative that the course of the epidemic be evaluated in terms of risk and crisis management to achieve lasting and effective results. However, taking the historical background and past experiences into account while planning risk and crisis management will be one of the most crucial strategies.

In general, the concept of risk means something that includes uncertainties in itself. The risk exists if statistics of probable distributions can be calculated for the outcomes of any given situation while uncertainty exists if there is no common attitude towards such a situation. Due to uncertain characteristics of risk, failure to make statistical inferences about a subject, and the uncertainty of repeatable risk situations even if they are made, cause a lack of foresight in terms of decision-making and planning. Therefore, it is necessary to state that any uncertainty is one of the important points to be evaluated within the scope of risk management. In classical risk analysis approaches, it is stated that decision-makers should evaluate the situation with a holistic perspective, taking the uncertainty into the scope of the analysis according to possible future results [14]. In order to determine the risk factors in risk analysis, a pre-risk scanning system should be established at first. The activities carried out in the screening system also require an effective crisis management since the goal in risk management is not to eliminate the risk, but to overcome the crisis by minimizing the damage in the event of a possible crisis [15]. Hence, it is necessary to activate the process of crisis management in determining the ways to be followed in risk analysis. As a matter of fact, the steps in the scanning system that are determined in analyzing the risks in risk analysis approaches are defined in relation to the crisis and

crisis management. According to Özer [16]; the steps determined in the scanning system that makes risk analysis possible are presented below;

**Problem Management:** The solution of the existing problem is evaluated as a type of problem that will affect those at risk. In this step, the negative effects of the problem are tried to be reduced. In this respect, the problems must be classified into short and long term effective categories. Since some problems may trigger crises in the long or short term, crisis screening should also be done for them.

**Risk Evaluation:** In this step, weaknesses that may cause a crisis are determined by defining risk factors. Therefore, a number of measures must be taken to eliminate weaknesses before possible crisis situations are identified.

**Relations with Groups at Risk:** In risk situations, the groups that will be most affected by the threats of this risk must be determined and contacted. Communication with these groups will be most effective and useful in times of crisis.

By raising awareness before the crisis, the panic situations that will occur during the crisis and the new risks and crises to be created by these situations will be prevented. The risk screening system formed by determining the steps above will render the risk determination process more concrete and planned. In the implementation of the risk screening system, a successful risk management process must be performed by following the steps of defining, measuring, judging and evaluating the risk and finally analysing it. In the risk management process, it is targeted at the basic identification, control and recording of the threats and opportunities, minimizing the risks, maximizing the gains, preventing and reducing the losses, optimizing the gains, managing the crisis effectively and finally reaching at the maximum management capacity [16]. If we schematically express the risk management process under general headings in line with the steps listed above, the following steps will appear.

In line with the steps given in **Figure 1** regarding the risk management process, in case of an infectious outbreak, the current risk situation must fit be identified. Elimination of the uncertainty about the existence of the risk situation is a priority in order to determine the next steps to be followed. When making risk evaluation after the situation is identified, the harming potential (impact) of the disease, the



**Figure 1.**  
Risk Management Process (<https://www.mha-it.com/2020/01/29/risk-management/>).

rate of exposure to the agent in the society and the susceptibility of the society must be taken into account. However, a number of questions arise in the following: Who are the population or groups at risk? What is the level of risk evaluation (local, regional, national etc.)? Who are the people who will carry out the risk evaluation phase? and What is the time frame specified in the risk evaluation?. Seeking reasonable answers to these well-defined questions during the epidemic will enable the risk evaluation phase to be carried out more systematically [17].

Risk control and precautionary analysis following the risk evaluation phase are of vital importance for risk management since the tools and precise strategies that reduce, inhibit or eliminate the risk are determined at this step [18]. At this point, it is necessary to identify a number of methods in line with the data obtained from the epidemics in the past. However, the formation of a team of experts in the field considering the essence of the decisions to be taken is important in determining the strategy and tactics to be practised. Otherwise, that will bring about new risk situations. Another point to be mentioned about this step is to ensure that all segments of the society are aware of the determined methods and strategies through means of modern information technologies. In this process, the mental health of the society must be thoroughly monitored while the existing bad conditions should be improved as much as possible and the hopeful message that no individual in the society is alone and this challenging process will be overcome together should be communicated. These steps requiring an effective use of mass media must also be managed accurately and in a controlled manner.

The tools and methods that ensure risk control are identified in the third step by considering all uncertain, probable and certain situations, and the necessary decisions are taken to move to the next step [19]. These decisions are taken by the administrators who are in appropriate positions and the process of making controlled decisions is initiated by analyzing all costs and benefits [16].

In the fourth step of implementing the decisions taken, the strategies determined and developed by using time and resources are started to be practised. In order to achieve that, a good communication between decision-makers and the risk group must be established beforehand. In the previous stages, it is necessary to convey the decisions taken to those in the risk group properly, to express the expected attitudes from the risk group and to ensure the maximum participation of everyone in the risk group since this step will ensure elimination of the threats, reduction of the effects of the threats or minimization of the number of people affected by the threats. Therefore, the actions to be performed require a high level of coordination and harmony [5].

After the successful implementation of the decisions, the next action is to monitor the course of the event. In the process of monitoring the event, problems must be identified and eliminated if possible while the people in the risk group should be encouraged to abide by the decisions and the control efficiency of the process must be ensured for the continuity of the process [18]. Then, the same process must be repeated by making a risk evaluation for new situations that occur after the decisions made [18].

In order to go through a successful risk management process, the aforementioned five steps must be fulfilled in accordance with the requirements. In addition, individuals or groups that play an active role in the risk management process should pay attention to some factors including “avoiding unnecessary risk, taking risk decisions at the appropriate level, accepting risk when the benefits are superior to the costs” [19].

While evaluating epidemics in terms of risk, crisis, risk and crisis management, it can be said that the risk during such outbreaks is generally a combination of the possibility of an infectious disease to trigger an epidemic and its impact size [17].



On the other hand, a crisis refers to an unpredictable, unexpected and unusual situation that occurs abruptly [20]. From this point of view, it should be stated that epidemics that cannot be identified by the health community also create a crisis situation. In addition, the risk may also vary depending on the conditions of the country/region, political landscape, perceived risk and interest of the media and society. On the other hand, crisis situations are also shaped by the perceptions of the masses. The extent of the crisis is affected by the life experiences of the society where it emerges in view of the perception of the threat it created. Therefore, probabilities such as the emergence of crises, their impact, and the groups they will affect should be taken into serious consideration when making a risk evaluation. The main purpose of risk evaluation within the scope of combating unknown/unidentified epidemics is to initiate emergency interventions, constrict the epidemic with a specific treatment and non-pharmaceutical public health measures specifically for the disease that is not eliminated by a vaccine when the disease is first encountered, and mitigate its impact. In this context, performing a risk analysis/evaluation refers to a process that is started by identifying the event and continues until it is taken under control [17]. Therefore, the steps of the risk scanning system in the aforementioned risk analysis approach should be carried out systematically in the risk management process. In addition, risk assessment carried out with the screening steps within the scope of risk analysis should be carried out with an interdisciplinary approach by experts in the field and with the participation of the society in the process. On the other hand, the crisis and crisis management issues should not be ignored while performing risk analysis and evaluation. Identification of threatening issues should also be considered in the context of crisis management since there is a high probability of crises to occur in situations where risks exist [5].

The questions to be answered in order to determine the crisis possibilities in risk management and to terminate the process successfully are as follows [13]:

- What is the critical level of the situation?
- What is the worst thing that could take place?
- What is the main factor of this chaos?
- What are the alternative solutions?
- Which groups/persons will be affected by this situation at the most?
- What is the expected attitude of the groups that will be affected by this situation during the crisis?
- What is the fundamental strategy to be put into action in case of an expected crisis?
- Who should take action throughout the process?

Strategic methods and tactics determined in line with the answers given to these questions should be applied in relation to risk and crisis management.

One of the issues strongly emphasized in evaluating risks and crises in terms of outbreaks is sharing the results of the risk analysis, in other words, proper communication of the identified risk. The risk must be interpreted and shared with the parties at every stage of the evaluation. Communicating or sharing the risk with



appropriate language will not only help the public to prepare for the measures to be taken and increase participation, but also guide the preparation of protocols for laboratory-based test development, diagnosis, monitoring and treatment [4].

Risk, crisis management and evaluation processes are defined as a combined process of three-components in which up-to-date information is collected, evaluated and recorded on a continuous and regular basis to manage an acute public health issue [5]. It is possible to categorize these components into three groups: threat, exposure and contextual evaluation. In the threat evaluation of an epidemic, answers to the following questions are sought;

- Does the epidemic virus cause disease in humans?
- What are the clinical findings of the disease?
- What characteristics of humans do make them vulnerable to the disease?
- Is it a formerly encountered disease?
- Are there any special factors for the spread of the disease?
- Which findings can help us in its diagnosis?
- Is there an effective treatment method for the disease?

Secondly, answers to the following questions are sought in the exposure evaluation:

- How many people get sick?
- What are the ways of transmission?,
- What is the level of contagiousness of the disease?
- What kind of symptoms does the disease cause on the patient?
- Can the symptoms of the disease cause permanent or temporary health damage?

Finally, answers to the following questions are sought in the contextual evaluation;

- What kind of effects does the disease have at local, regional, national and global level?
- What is the susceptibility of the society to the disease in the local environment?
- How does the healthy and cultural behavior of individuals in the society affect the course of the disease?

In the event of an epidemic, the answers sought to the questions listed above and the answers given to these questions will make it possible to make a successful risk and crisis management evaluation about the disease. Another important issue

at this point is to be able to adapt past experiences to today's conditions by learning from past experiences and knowledge, whether or not the disease that caused the epidemic has the same characteristics as in the previous period. As a matter of fact, making these adaptations is one of the main factors that will enable us to carry out risk and crisis management effectively [5].

The COVID-19 outbreak that started in Wuhan, China; On March 11, 2020, more than 118,000 cases in 114 countries reached 4291 deaths and were approved by the World Health Organization (WHO) as a pandemic [21]. Since WHO proclamation of COVID-19 as a pandemic, the global spread rate has increased and the spread in the society persists in many countries. Updated number of cases and an interactive map highlighting confirmed cases worldwide are available on the websites of the World Health Organization and the European Center for Disease Prevention and Control [22].

Infection is mainly transmitted through droplets. It is generally reported that the incubation period is between 2–14 days and the average incubation period is 4.8 days. The contagious period of COVID-19 is not exactly known. It is thought that it starts a couple of days before symptomatic period and ends up with fading of symptoms [23]. The whole society is vulnerable to COVID-19. Healthcare professionals are the most risky occupational group in terms of encountering the infectious agent. Men, people over the age of 50, those with comorbidities (hypertension, cardiac disease, diabetes mellitus, malignancy, COPD, renal failure, etc.), seasonal agricultural workers and those living in nursing and rehabilitation centres, schools, barracks, detention houses and immigration camps are among vulnerable groups in terms of COVID-19. The clinical indicators of infection range from non-mild symptoms to severe pneumonia with organic functional damage. Common symptoms include fever, cough, dyspnoea and myalgia. Symptoms such as sore throat, chest pain, hemoptysis, conjunctival congestion, nausea and vomiting, headache, runny nose, painful muscles and joints, extreme weakness, loss of smell and taste, and diarrhea can also be seen [24]. The first COVID-19 diagnosis in Turkey was made on March 11, 2020, and some precautionary actions were taken to prevent the spread of the disease and to treat patients. In line with the epidemic plan, a multi-sectoral approach has been applied and preventive measures have been put into practice that address the society as a whole. During this process, pandemic action decisions started to be implemented in Family Health Units. The administrative decisions register that is approved by every physician working at the Family Healthcare Centre included the measures to be taken during the pandemic process and the changes to be made in FHC's operation in written form [24]. There is no vaccine or medicine yet to protect against COVID-19. The best way to prevent the infection is to avoid exposure to the virus [25].

## **2. Global overview**

In China, efforts to prevent spread of COVID-19 have been used the basic principles that include identifying and isolating infectious sources and cutting off transmission routes. As of January 31, 2020, about 12,000 cases were confirmed and 18,000 cases were suspected in China. Studies have reported that the spread of COVID-19 is relatively rapid and reached to many other countries after its outbreak in China. On January 31, 2020, 213 cases of deaths were reported worldwide. As of the same date, confirmed cases have been reported in the following 19 countries outside China: Australia (n = 9), Canada (n = 3), Cambodia (n = 1), France (n = 6),

Finland (n = 1), Germany (n = 5), India (n = 1), Italy (n = 2), Japan (n = 14), Nepal (n = 1), Malaysia (n = 8), the Philippines (n = 1), Republic of Korea (n = 11), Singapore (n = 13), Sri Lanka (n = 1), Thailand (n = 14), United States of America (n = 6), United Arab Emirates (n = 4) and Vietnam (n = 5) [26, 27].

The disease gradually spread all over the world and the epicenter of the pandemic subsequently shifted from Wuhan in China to Europe and the USA. The infection has a very dynamic structure spreading rapidly. The number of confirmed cases varies due to differences in epidemiological surveillance and diagnostic capacities across countries. Since a reliable treatment method has not yet been devised for this type of virus, controlling the rate of spread requires effective planning of healthcare infrastructure and services. Therefore, the estimation of the total confirmed cases and possible new cases in the future is vital for directing the demand to the healthcare system and managing the pandemic [28].

Italy is the first country in Europe to be seriously challenged by a large number of deaths from COVID-19, followed by Spain, France, Germany and the United Kingdom. European countries have taken measures such as flight restrictions, closing down borders, cafes and restaurants, and suspending education to prevent the spread of the disease. The UK and the Netherlands took a ethically different and ominous approach targeting at herd immunity. However, even these two countries eventually had to resort to some measures and restrictions [29]. In the USA, the first COVID-19 case was reported in Washington State on January 15, 2020 [30]. On January 20, state and local health departments in the United States initiated monitoring of all people thought to have had close contact with people infected with COVID-19. The purpose of these efforts is to ensure rapid evaluation and care of patients, limit further transmission and better understand underlying risk factors. A number of measures such as active symptom monitoring consisting of daily phone calls, texting or face-to-face conversations about fever or other symptoms during the 14 days following the last known exposure to a COVID-19 confirmed person, were conducted by local health organizations. In addition, specific guidelines for health services (infection control and prevention, laboratory testing, environmental cleaning, worker safety and international travel etc.) including patient management have been developed and published online. These guides are updated as we learn more. US public health authorities still continue to study on clarification of virus incubation period and duration with implications for quarantine time and other mitigation measures, the relative importance of various modes of transmission (understanding these modes of transmission has major implications for infection control and prevention, including the use of personal protective equipment, determination of the severity and fatality rate of COVID-19 in the US health system, as well as more detailed description of the infection spectrum and risk factors, identification of the role of asymptomatic infection in ongoing transmission; and to assist in the development of vaccines and therapeutic interventions and finally evaluating the immunological response to infection. As of June 27, 2020, the total number of diagnosed cases worldwide reached 9.9 million. The number of people who lost their lives was nearly 500,000. The United States was the country with the highest number of cases (n = 2.5 million), followed by Brazil (n = 1,280,000), Russia (n = 627,000) and India (n = 510,000) respectively. The highest number in Europe was seen in the UK with 310,000 cases. Other countries in Europe with a high number of cases were Spain (n = 295,000), Italy (n = 240,000) and Germany (n = 195,000) respectively. Considering the number of casualties, the United States ranked as the first country with 127,000 deaths. Other countries with a high number of deaths are Brazil (n = 56,000), United Kingdom (n = 43,000), Italy (n = 34,000) and France (n = 29,000) respectively [24, 31].

### **3. Overview of Turkey**

The first detected cases of Covid-19 were announced on 11 March 2020 by the Ministry of Health in Turkey and the first death case due to the virus took place on 15 March, 2020. The Ministry of Health also announced that coronavirus cases were confirmed all over Turkey on 1 April, 2020. As of June 27, 2020 the number of people infected with the coronavirus in Turkey was 190,000 while the number of those who lost their lives due to virus was about 5,000. On this date, Turkey outnumbered China where the first cases were seen and ranked 12th after Germany while ranking as 17th among 185 countries in view of death cases [24].

### **4. COVID-19 outbreak management in Turkey**

The Ministry of Health established an Operational Center on January 10, 2020 against possible risks after the COVID-19 outbreak started in China, and urgently formed the Scientific Committee, which plays a critical role in outbreak management. COVID-19 outbreak management is carried out under the coordination of the Ministry of Health and in cooperation with the sectors within the framework of the “Pandemic Influenza National Preparation Plan”, taking into account the recommendations of the Scientific Advisory Board. The impact of the COVID-19 measures taken by central institutions and organizations is increased by the city-specific evaluations made by the “Provincial Pandemic Committees”. During the outbreak period, required measures are taken and implemented for the infection chain specific to COVID-19 within the scope of public health management. These measures can be classified as source-oriented measures (detection and notification of infected persons, isolation and treatment of the patient, filiation, screening studies, examination and follow-up of contacts, quarantine practices, health education), measures for the route of transmission (social distance, hand hygiene, respiratory hygiene, surface cleaning, disinfection, frequent ventilation of indoor environments, improvement of indoor air quality, use of appropriate personal protective equipment and health education in line with the risks when necessary, and measures for the host (health education, adequate and balanced nutrition, sufficient and regular sleep, physical exercise, cessation of smoking, etc.), reducing the possibility of exposure to the agent (limiting collective activities in the streets, flexible working/working from home, reducing contact time, shortening the shifts and organizing rest intervals, etc.) and early diagnosis and treatment of cases [32].

Community-level measures have also been initiated while finding and monitoring the cases and their contacts. When starting or ending a measure against the community, factors such as costs, social problems and “precautionary burnout” in the society are taken into account, ensuring that they will not cause an increase in cases again. Different communication strategies are used effectively to ensure social participation since the compliance of the society with the measures is an important factor in outbreak control. Compliance with different measures is monitored by qualitative and quantitative methods, and new measures are taken against decreased compliance and burnout over time. The size of the measures may differ according to the risk level and local measures may be required by surveillance data. In addition to the “Provincial Pandemic Plan”, “number of new cases, incidence and cumulative incidence rate, number of cases and distribution of incidence by district, age group, gender, vulnerable groups etc., number of cases healing daily, and mortality rates” are used in order to evaluate the COVID-19 outbreak at the provincial level [24].



An effective surveillance system should be implemented in order to make evidence-based decisions in outbreak management at national and provincial/district level. Coordination between central and provincial organizations should be carried out at the highest level in outbreak control and prevention procedures by sharing data analysis and evaluations at the provincial/district level with the teams involved in the data collection process [24].

## **5. Primary COVID-19 outbreak management in Turkey.**

In the light of this information, the most critical measure to be taken during the pandemic process is usage of personal protective equipment (PPE) by the whole society, especially healthcare workers. In order to prevent the coexistence of healthy people and possible COVID-19 cases and transmission routes at the first contact places of the health system, WHO's screening and triage recommendations for COVID-19 should be followed [33]. For this reason, Family Health Unit (FHU) employees were made to wear PPE (mask, gloves, visor or goggles, aprons) and every patient admitted was obliged to wear a mask. A triage unit has been created at the entrance of FHU. By measuring the fever of each patient and questioning his/her history (fever, cough, breathing difficulty, contact and travel history), possible COVID-19 cases were tried to be diagnosed by the assistant health personnel working here (nurse, midwife, paramedics). Suspected cases were evaluated by taking them to the isolation unit at the entrance of the FHU and thus the possible contamination risk was reduced. Patients deemed at risk were referred to a higher level health institution by contacting the Provincial Health Directorate. The patients who were not deemed to be at risk were admitted in a certain order in accordance with social distance rules and the size of the FHU waiting rooms. Hand disinfectants were available in FHU entrances and exit and waiting rooms. Procedures for FHU hygiene were restructured in accordance with the directives of the Ministry of Health [33].

In Family Health Units where primary health care services are provided, preventive health services are most frequently resorted for medical procedures such as having an examination, prescribing medication, getting an injection, dressing and various health reports. People can access all these services by applying to their registered family physician, patients were primarily directed to family health centers by the Ministry of Health in order to reduce crowding that may occur in secondary and tertiary healthcare providers during the pandemic process, and some regulations were remade for FHU applications [33].

Treatments and preventive health services are provided together in primary health care institutions. Preventive health services include primary, secondary and tertiary prevention [33]. Primary prevention involves the procedures performed to prevent or eliminate the cause of any health problem before it emerges in the individual or society. Secondary prevention includes the measures taken to identify a health problem in a person or community at an earlier stage. In this way, treatment becomes easier, thereby its spread is prevented and its impact is decreased in the long term [34]. Considering how simple but effective measures such as quitting smoking and avoiding obesity can prevent many diseases and save lives, the importance of especially primary preventive health services can be understood better. During the COVID-19 pandemic, primary and secondary prevention methods have been effectively used. The precautions taken to avoid contact with the virus and the early diagnosis and isolation of the contacts from the environment played a leading role in attenuating the impact of COVID-19 pandemic. Many health policies have been created to prevent this contact. In our country, in order to control the epidemic, to identify the first source, and to monitor and isolate the contacts, filiation was enforced

under the leadership of Provincial Health Directorates/Community Health Centers in accordance with the rules determined by the Ministry of Health. During the pandemic process, family physicians also took an active role in the filiation. Persons at risk were monitored by the family physicians and/or family health workers in line with the criteria set by the Ministry of Health. A person with confirmed or suspected COVID-19 and others who had close contact without taking protective measures against droplets were quarantined for 14 days after their last contact. Those whose tests were negative were quarantined for 14 days. Those whose tests were positive were quarantined for 14 days after 4 days without symptoms. Those who completed military service were quarantined for 14 days after they returned home. Those who were abroad and returned home were quarantined for 14 days. All these people were questioned by phone especially in terms of fever and respiratory symptoms, and informed about the quarantine conditions and closely monitored [33].

As a result, the COVID-19 pandemic has deeply affected our lives in our country as well as all over the world and showed that we need to rearrange our life norms. It is inevitable that such kind of epidemics will recur in the globalizing world. Therefore, social awareness and protective measures are essential. In the Covid-19 outbreak everyone should be vigilant until the last case is healed, and precautions taken in family health centers, which are the front line of health services, should continue to be implemented. Preventive health services should be constantly supported, and risky/possible cases should be monitored and filiation should be continued [33].

The COVID-19 pandemic had severe health and economic consequences both in the world and in our country. An effective treatment and vaccine for the infection has not yet been found. The best intervention that could be done to reduce the contagiousness of the disease is to maintain social distance, comply with hygiene rules and wear a mask. Community immunity is another way to control pandemics. In short, it is a way of protecting individuals indirectly from an epidemic to develop immunity in the majority of the population. When it is desired to ensure community immunity by reducing protective measures, the number of cases and deaths will be increased. On the other hand, when it is desired to maintain strict protective measures until the vaccine is produced, it will take time to be widely implemented in the world. Political decision-makers should work in coordination with academia, relevant governmental institutions and non-governmental organizations in order to evaluate the psychological, sociological and economic effects of maintaining all the measures in the society and to make the best decision within the possible benefit/loss relationship.

An outbreak management, as stated by İnandı and et al. [16], should be addressed as follows. Considering the differences in dynamics and intervention methods, the outbreak can be examined in five phases:

**Initial Phase:** During this period, sporadic and importing cases emerge. Cases are localized at first and transmission is slow. Then clusters of cases begin to appear.

**Peak Phase:** It is the period when there is widespread human-to-human transmission in the community and the outbreak curve begins to rise. In this period, the reproduction number-defined as  $R_0$  (the average number of new patients that a patient can infect the disease in a fully susceptible society) is greater than 1 and the number of patients in the community gradually grows. If the contagiousness of the agent is high, the number of sick people may increase in a very short time and constrain the capacity of health systems. During the outbreak, as some people get sick, the susceptible population will decrease.  $R_0$  changes and this new reproduction number is called as the effective reproduction number -  $R_e$  [35]. During the peak period, the concept of “the number of cases increasing exponentially” is also an important concept. If no precautions are taken, the number of people affected

in the epidemic increases rapidly and exponentially, as each sick patient infects the disease to new people. In this phase, the number of days to double the cases is short.

**Plateau Phase:** The peak is followed by the plateau phase, in which the rate of increase in cases decreases. During this period, the number of patients detected daily is high while there is no significant increase compared to the previous days. The outbreak curve forms a near-straight line. The  $R_e$  value is about 1.

**Bottom Phase:** There is a continuous decrease in the number of new cases. Although  $R_e$  is below 1, it is still close to 1 and the control of the disease has not been fully achieved yet.

**Control Phase:** It is the phase where the number of new patients is substantially reduced and a flat course is seen because the outbreak is under control or people in the community have recovered to a large extent. At this stage,  $R_e$  value is below 1 and gradually decreases. If the disease inherits immunity, the longer the time in the epidemic increases, the less susceptible people are. The presence of the vaccine and its administration to susceptible people are important in controlling the epidemic. Person-to-person transmission can be avoided by reducing the number of susceptible people through vaccination (community immunity), but this is unlikely for COVID-19 since there is currently no effective vaccine available.

## 6. Indicators that can be used for decision-makers to evaluate risks and intervention according to the stages of the outbreaks

As in the chain of infection in all infectious diseases, the agent in COVID-19 (source) arises as a result of the interaction between the transmission route and the host. Breaking this chain through various interventions will provide the opportunity to control the epidemic at first and then interrupt it. These interventions range from efforts that focus on limiting the disease in a specific region (suppression) to reducing the social effects of the epidemic (impact reduction), and this variability also reveals the differences in crisis management strategies of the countries [36]. In this period when there is no progress in vaccination and treatment, it is aimed to minimize the “impact” that will arise by evaluating the interventions aimed at lessening social exposure together with the risk. Case-specific decision matrices are used in scoring this impact and risk evaluations are made by crossing the risk elements and the availability of intervention tools. An example of this type of risk scoring has been used by the World Health Organization to evaluate sporting events and religious activities in terms of COVID risk [17].

İnandı (2020) and his friends the risk factors and intervention opportunities specific to the upward and downward stages of the epidemic prepared by reviewing the guidelines and recommendations of the Ministry of Health, national and international organizations are grouped below [17]. Here, the risks and intervention tools that decision makers should consider in their own provinces are pointed out. It is possible to duplicate the indicators presented in this table. To do this, the “question generator” approach described in the risk assessment section of the article can be used. When appropriate questions are asked according to the phase of the outbreak, relevant indicators can be created as shown in the table. For example, the following questions can be asked to determine the indicators for populational characteristics:

- What is the rate of the high risk age group in terms of infection in your province?
- Since it increases the risk of contact in our city, what are the places/districts where the population density is high?

Intervention possibilities according to the phases of the outbreak are also listed below. Accordingly, for example, if it is concluded that the risk has been evaluated during the bottom phase and the risk is reduced, appropriate interventions can be selected and implemented gradually in health services at community and individual level.

## **7. Examination of risk factors and intervention opportunities according to different phases of the outbreak**

### **7.1 Peak/Plateau**

#### *7.1.1 Risk factors*

- Population and geographical features
- Populational characteristics (population aged 60 and over, population density)
- Presence of places where people live together such as prison, military barracks, nursing home, etc.
- Multiplicity of disadvantaged groups (such as immigrants, poor groups)
- Distribution of the population by educational, income and social security status, existence of regions where inequalities are highly concentrated
- Features of working and economic life (Heavy industry, informal working conditions, child labor, seasonal work, high number of touristical businesses, etc.)
- Neighborhoods of the city (infectious status of neighboring provinces or bordering with the country affected by the outbreak)
- Business of travelling (airports, presence of an airport with international flights, road mobility)

#### *7.1.2 Morbidity and Mortality Criteria*

- Status of the general health indicators of the province (maternal and infant deaths, vaccination rates, etc.)
- The prevalence of the groups susceptible to coronavirus (such as DM, CHD, COPD, HT)
- Basic epidemiological information regarding the outbreak and the availability of this information (distribution by age, location, specific groups, detailed data on test practices, contacts, treatment, isolation and quarantine processes)
- Existence of a region with a cluster of cases
- Mortality criteria (distribution of deaths by age and gender, rates specific to disease groups/risk factors, case fatality rate)
- Completeness, accuracy and transparency of all health records, especially the death registration system



- Health Services
- Pre-epidemic status of primary health care services (population per family physician, number of nurses)
- Pre-epidemic status of secondary and tertiary health services (sufficient number of physicians and nurses, beds, intensive care beds, medical device or equipment availability)
- Status of emergency health services in terms of manpower, vehicles and equipment
- The status of the health service provision in terms of manpower, vehicle and equipment in places where people live collectively (prison, military barracks, nursing home, etc.)
- Status of workplace health services in terms of manpower, vehicle and equipment
- Personal protective equipment (PPE) availability
- Preparedness of health services at all levels for any outbreak (emergency action plan, presence of hospital disaster plan)
- Readiness of the health workforce (education, awareness)
- The nature of coordination and cooperation between all private and public health institutions
- Health Information Resources and Effective Communication
- Adequacy and availability of reliable information sources
- Health literacy level of the population
- Effective risk communication by the government
- Intersectoral Cooperation
- The nature of cooperation between non-governmental organizations, local administrations, private sector, universities, professional associations, media and central authorities

## **7.2 Intervention Opportunities/Capacity**

- Health Services
- Coverage of diagnostic possibilities (screening in all suspicious and contacted cases and collective living places)
- Coverage of treatment options (Hospitalization opportunity for all COVID positive cases, drug supplement)

- Sufficient physical infrastructure capacity (hospital, intensive care bed, ventilator) –
- Presence of pandemic hospital practices
- The sufficient quality and quantity of health workforce involved in the battle against the outbreak
- Availability of up-to-date algorithms for case/contact management during outbreak in healthcare at all levels
- Providing qualified and sufficient PPE for health workforce
- Continuity of PPE training for newly employed staff
- Recording and monitoring the effects of healthcare workers
- Adequacy of monitoring and quarantine facilities
- Contact finding (searching for sources and contacts through all diagnosed cases) isolation and monitoring capacity (team, equipment)
- Existence of an effective surveillance system and support with information tools, compliance with WHO
- Ensuring completeness and accuracy in COVID diagnosis, treatment and death records
- Creating basic epidemiological information on the outbreak, preparing technical reports and publishing medical articles
- Sharing data in openness that allows secondary analysis
- Creating out-of-hospital isolation facilities (hotel, dormitory, building field tent)
- Proper integration of family physician facility, workplace and emergency health services via 2nd and 3rd level institutions
- Integration of health service provision in collective living areas (prison, nursing home, etc.) to outbreak management

#### *7.2.1 Individual Precautions Regarding Disease Control*

- Promotion of personal hygiene (especially hand washing and respiratory hygiene), availability of hand washing facilities in all settings
- Encouraging the use of masks, providing in adequate amounts and controlling compliance to wearing masks
- Promoting physical isolation and controlling compliance
- Promoting homestay
- Quarantine and isolation procedures

### *7.2.2 Social Precautions Regarding Disease Control*

- Controls imposed on entering/exiting the country/cities, travel restrictions, closing of airports, quarantine application when entering the country
- Closing down workplaces and schools
- Declaring a curfew
- Banning of traffic
- Restrictions on public transport
- Restrictions on bazaar markets
- Banning of collective events
- Restriction/prohibition of public spaces/squares
- Governance
- Establishment and effective operation of the Scientific Committee
- Establishment and effective operation of pandemic provincial boards
- Effective risk communication
- Increasing access to reliable information sources

### *7.2.3 Bottom Phase*

- Population and geographical features
- The density of risk groups (population aged 60 and over, those with chronic diseases, those who live collectively in institutions (prisons, military barracks, nursing homes), immuno-compromised persons and the number and susceptibility of immigrants), presence of groups in which exposure is high when by mitigating the measures and consequences will be severe
- Education, income and social security distribution of the province, existence of regions where inequalities are concentrated
- The city's capability to attract/discharge immigration (potential to receive visitors from larger cities)
- Features of working and economic life (Heavy industry, informal working conditions, child labor, seasonal work, high number of touristical businesses, etc.)
- Business of travelling (airports, airport with international flights, road mobility)
- Seasonal changes and the existence of special events (religious holidays, visiting period of immigrants, weddings, celebrations, etc.) (the effect of the disease on control measures as well as transmission routes)

#### *7.2.4 Morbidity and Mortality Criteria*

- Status of the general health indicators of the province (maternal and infant deaths, vaccination rates, etc.)
- The prevalence of the groups susceptible to coronavirus (such as DM, CHD, COPD, HT)
- Basic epidemiological information regarding the mitigation of the measures against outbreak and the availability of this information (distribution by age, location, specific groups, detailed data on test practices, contacts, treatment, isolation and quarantine processes)
- Existence of a region with a cluster of cases
- Mortality criteria (distribution of deaths by age and gender, rates specific to disease groups/risk factors, case fatality rate)
- Completeness, accuracy and transparency of all health records, especially the death registration system
- Existence of a region with a cluster of cases
- Mortality criteria (distribution of deaths by age and gender, rates specific to disease groups/risk factors, case fatality rate)
- Completeness, accuracy and transparency of all health records, especially the death registration system
- Health Services
- Extent of unmet services during the outbreak (elective operations, outpatient services, follow-ups, continuous treatments)
- The capacity to meet the service burden that will be increases after returning to routine services (the sufficient number of physicians, nurses, etc. health staff per population)
- Personal protective equipment (PPE) availability
- Health Information Sources and Effective Communication
- Adequacy and availability of reliable information sources
- Health literacy level of the population
- Effective risk communication by the government,
- Intersectoral Cooperation
- The nature of cooperation between non-governmental organizations, local administrations, private sector, universities, professional associations, media and central authorities



- Health Services
- Increasing COVID-19 awareness among people in risk groups by healthcare personnel
- Improving risk groups' access to services (COVID-19 testing and treatment)

*7.2.5 Planning shifting to routine health services at all levels including primary health care*

- Organizing the service provision of the groups who could not receive service during the outbreak in all steps, preventing crowding in hospitals (Tele-medicine applications, examination intervals and timing that will not create congestion in the MHRS system)
- Increasing the coverage of COVID PCR tests (providing widespread test opportunities in collective living places, including asymptomatic cases)
- Increasing the rapid serological test capacity and ensuring its accessibility
- Development of monitoring systems and applications sensitive to personal rights
- Updating algorithms for case/contact management in outbreak in all levels of healthcare in line with scientific evidence
- Providing and maintaining adequate and qualified PPE for health workforce
- Continuity of PPE training for newly employed staff (new graduates, etc.)
- Planning the follow-up and control of the infected healthcare workers, existence of regulations for their personal rights
- Review of monitoring and quarantine facilities for a possible new epidemic
- Finding sufficient contacts (searching for the sources and contacts of the diagnosed people) isolation and monitoring capacity (team, equipment)
- The existence of an effective surveillance system and its support with information tools, its parallelism with WHO
- Ensuring completeness and accuracy in COVID diagnosis, treatment and death records
- Creating basic epidemiological information on the epidemic, preparing technical reports and publishing medical articles
- Sharing data in openness that allows secondary analysis
- Treatment opportunities (Hospitalization opportunity for all COVID positive cases)

### *7.2.6 Individual Precautions Regarding Disease Control*

- Promotion of personal hygiene (especially hand washing and respiratory hygiene), availability of hand washing facilities in all environments
- Encouraging the use of masks, providing in adequate amounts and controlling compliance
- Promoting physical isolation and controlling compliance
- Promoting homestay

### *7.2.7 Social Precautions Regarding Disease Control*

- Allowing entrances and exits to the country/city, gradual opening of airports to countries, abolishing the quarantine application after entrance
- Gradual opening of workplaces (certain days of the week, certain group workplaces)
- Maintaining physical distance at workplaces, defining rules and new practices (flexible working, rotating work, space arrangements)
- Gradual opening of schools (certain days, certain classes), determination of principles regarding the conduct of exams
- Availability of distance education/management facilities
- Gradual relaxation of the curfew (certain days, certain hours, certain groups, etc.)
- Defining the rules and new practices regarding public transportation
- Defining rules and new practices regarding bazaars and markets (crowding prevention and physical distance principles)
- Presence of new regulations regarding public areas and public transportation
- Existence of new travel regulations

### *7.2.8 Governance*

- Efficient operation of the scientific board
- Effective work of pandemic provincial boards
- Effective risk communication
- Providing access to reliable information sources [17]

The outbreak process we are experiencing has shown that pre-epidemic socio-demographic characteristics, social infrastructure, health system capability and

democracy culture, as well as combating strategies, make the struggle stronger or weaker [17]. These features function as a parameter in the risk evaluation guidelines of WHO and ECDC [37, 38]. The size of the outbreak and the change in the number of cases is shaped according to the characteristics of the agent and the route of transmission, as well as the characteristics of the society exposed to the agent and the adequacy of combatting opportunities, varying with the temporal characteristics (season, religious holidays, tourism) and geographical regions (urban–rural, metropolitan). In the battle against the virus, the status of resources at the country/local level (infrastructure, manpower, research and development etc.), preparedness, mobilizing capabilities, cooperation–coordination and participatory decision-making mechanisms in the organizational culture have gained importance [17]. In the battle against the Covid-19 virus, which has emerged with a new agent with many unknown findings, there is a need for those approaches that examine the risks with a global, national and local perspective on the basis of science and implement protective and preventive interventions in this direction.

For those countries such as Turkey having many cities with different geographical and climatic structure, populational characteristics and socio-economic conditions, there is an urgent need to be met in the risk evaluation and intervention at the provincial level. Even the regions where the risk will differ within the same province can be examined in this context. The provinces are authorized for additional measures to be taken by provincial pandemic boards, taking into account their own special circumstances [17]. In risk evaluation to be carried out at the provincial level, differences in age, socioeconomic and cultural characteristics, disadvantaged groups, collective living institutions, seasonal risks in the province should be addressed separately, and the framework of the intervention should be transformed into a gradual mitigation by examining these risks.

Equally important, or perhaps more important thing is whether information about the outbreak is accessible. “Experts” cannot be expected to make an accurate risk evaluation without basic data and essential information. Information is one of the most important pillars of decision-making processes of both individuals and social structures. It plays an important role in perceiving a risk and developing an attitude and behavior towards a subject. Accurate and shared information also contributes to the creation of a trustful atmosphere in the society. Decision processes based on scientific data and evidence are more successful in achieving desired results on a subject. Evidence-based decision making focuses on obtaining the best (optimum) result on a subject [39].

Another important issue in outbreak management is associated with ensuring community engagement [40, 41]. International health guidelines emphasize the importance of community engagement. Combining views and insights from different segments of society is of paramount importance in enhancing the well-being. That’s why healthcare professionals work with the community to plan, research, deliver and evaluate healthcare services. In the coronavirus pandemic, community engagement has been crucial in many collective responses, from compliance with the stay-at-home call to steps that countries need to take to alleviate restrictions, and help people who need support in the community through volunteering services [38]. The community wants to participate in the process [42]. This was evident during the pandemic process. Therefore, effective mechanisms should be established to include all segments of the society in outbreak management processes. Optimal results in an outbreak, a situation in which cases and deaths are minimized, fundamental rights and freedoms are protected, economic development and social life can be sustained, can only be achieved with an approach that provides transparency, evidence-based decisions, effective risk communication and community engagement [17].

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